

REMARKS

The specification and claims have been carefully reviewed in light of the Office Action mailed July 1, 2009.

Claims 1 and 21 have been amended, without prejudice, to specify that the porous material produced by the inventive method is water soluble. Support for this subject matter may be found in claim 22, which has been canceled, without prejudice. Claim 23 has been amended for proper antecedent basis to claim 21. Basis for the independent claim 1 can be found throughout the present application, for example at page 4, lines 12 and 13, page 5, lines 14 to 16 and page 10, lines 16 and 17 of the application as originally filed.

The Present Invention

The present invention relates to a method for producing a water soluble porous material comprising the steps of; (a) providing a C/W emulsion comprising an aqueous phase, a matrix building material, a surfactant and liquid CO₂ phase; (b) at least partially freezing the aqueous phase; (c) gasifying CO₂ from the liquid CO₂ phase to form an intermediate porous material; (d) venting the gasified CO₂ from the intermediate porous material; and (e) freeze drying the intermediate porous material at least substantially to remove the aqueous phase and form the porous material. The present invention also relates to a water soluble porous material obtainable by the method.

Claim Rejections – 35 USC § 102

Claims 1-15 and 17-30 were rejected under 35 U.S.C. 102(b) as being anticipated by Ko, et al., (US 2003/0134918).

According to the Office Action, Ko, et al., teach compositions replacing the oil in an oil-in-water emulsion with supercritical fluids, such as CO₂, (paragraph [0007]); After polymerization, the CO₂ is easily extracted from the polymer as a gas (paragraph [0008]); By controlling the nature of the emulsion, and the polymerization process, nanopores can be created (paragraph [00008]); Ko, et al., further teach that by depressurization, the CO₂ is vented away, and all or a portion of the oil phase is removed (paragraph [0044]); Solvents, particularly those used in the liquid form, can be removed by freeze-drying (paragraph [0032]); Operations such as vacuum removal, removal driven by air pressure, pressing the foam, or other methods can be used to remove the oil phase, the supercritical fluid, remaining water, emulsifier, initiators, or any other unpolymerized material from the foam (i.e., there would be no solvent residue remaining in the material) (paragraph [0044]); etc.

Further according to the Office Action, examples of monomers to be dispersed within the water phase of the invention are in paragraph [0053]. ; The water soluble materials are free from a substantial degree of cross-linking, as cross-linking tends to render a material water insoluble (paragraph [0030]); The composition of Ko, et al., may further comprise cellulosic fibers (paragraph [0049]); etc.

Applicants respectfully traverse.

Applicants respectfully submit that Ko is not a proper anticipatory reference under 35 U.S.C. 102(b). Ko was published on July 17, 2003, whereas the present application claims a priority benefit to August 4, 2003. As less than a year exists between these dates, 35 U.S.C. 102(b) does not apply.

In any event, claim 12 cannot be anticipated because, as acknowledged in the obviousness rejection in the Office Action, "Ko, et al., do not expressly teach reducing the temperature of the emulsion of a range of from -5°C to -30°C ."

Ko also does not explicitly disclose all of the steps of the method of claim 1 of the present application. For example, Ko does not disclose step (b) of the method of claim 1, in which the aqueous phase is partially frozen, or step (e) of the method of claim 1, in which an intermediate porous material is freeze-dried to at least substantially remove the aqueous phase (although freeze-drying is mentioned in paragraph 32 of Ko). Thus, the amended claims of the present application are novel over the disclosure of Ko.

In the methods disclosed in Ko, cross-linking of the monomers occurs such that the resulting foams are not substantially water-soluble. It is clear from the teaching in Ko that cross-linking occurs, for example from the teaching in paragraph 15 of Ko which states that a flexible foam is produced. Applicants respectfully submit that, in contrast to the polymeric foams disclosed in Ko, the materials according to the present invention are not flexible and are quite brittle and easily crushed because of the porosity and absence of cross-linking. Additionally, paragraph 22 of Ko defines the cross-linkers used and refers specifically to the use of unsaturated carboxylic acid which may undergo cross-linking to form a superabsorbent polymer and paragraph 38 of Ko refers to the use of a rubbery co-monomer and a cross-linking agent.

It is further apparent from the teaching in Ko that the foams it describes are not water-soluble, as the foams are described as absorbent composites. Specifically, in paragraph 5, Ko teaches that the invention relates to providing an absorbent composite which exhibits an improved fluid intake rate, which further shows that the polymeric foams absorb moisture and do not dissolve. Paragraph 10 of Ko refers to use of the polymeric foams in personal care items such as diapers and feminine hygiene products, again showing that the polymeric foams must absorb and not dissolve. Paragraph 18 of Ko refers to the use of monomers that produce a water-absorptive polymer. Thus,

there is no disclosure in Ko of a method of preparing a substantially water-soluble porous material, or of such a material.

The dependent claims are not anticipated as dependent on non-anticipated claim.

Claim Rejections – 35 USC § 103

Claims 12, 16 and 23 were rejected under 35 U.S.C. 103(a) as being unpatentable over Ko, et al., (US 2003/0134918).

According to the Office Action, as to claim 12, Ko, et al., do not expressly teach reducing the temperature of the emulsion of a range of from -5°C to -30°C . However, since Ko, et al., teach freeze-drying the composition to remove solvent (paragraph [0032]), one of ordinary skill in the art would recognize that freezing includes exposing the substance to temperatures which fall within instantly the claimed range.

According to the Office Action, as to claim 16, Ko, et al., teach that the water phase of the invention comprises from about 20% to about 80% monomer and from about 0.015 to about 5% emulsifier (paragraph [0055]).; However, Butler, et al., (2001) (*Advanced Materials* 2001, 13, 1459-1463) teaches CO_2 -in-water emulsions comprising 70% to 80% CO_2 , 10% by w/v poly (vinyl alcohol) relative to water, and 1 to 10% surfactant w/v based on water (page 1460, column 2, paragraph 2, lines 104 and page 1461, paragraph 2, lines 5-8).; It would have been obvious for one of ordinary skill in the art to use the concentrations of each component as specified by Butler, et al., in the invention of Ko, et al., because using the concentrations results in a system in which free-radical polymerization occurs before the emulsion becomes destabilized (Butler, et al., page 1460, column 2, paragraph 2).; etc.

According to the Office Action, as to claim 23, the foams produced according to the invention of Ko, et al., have pore volumes of from 6 cc/g to 200 cc/g.; The bulk density would therefore be from 1/200 g/cc to 1/6 g/cc, or from 0.005 to 0.16 g/cc (paragraph [0028]). ;The polymeric foam further has an average cell size of 50 microns or less (paragraph [0038]). These ranges overlap the values given in instant claim 23.

Claim 18 was rejected under 35 U.S.C. 103(a) as being unpatentable over Ko, et al., (US 2003/0134918) and further in view of Rehmer, et al., (US 4,879,361). According to the Office Action, Ko, et al., teach the composition as applied to claim 1 but do not expressly teach that the porous material is in the form of porous particles or beads.; However, Ko, et al., teach that the material can be molded into any desired shape (paragraph [0068]).; Rehmer, et al., teach polyacrylic acid in bead form (column 16, lines 42). ; Because polyacrylic acid can be shaped into bead form (as taught in Rehmer, et al.), it would have been obvious to one of ordinary skill in the art that the composition of Ko, et al., which can be formed into any desired shape (and which can comprise polyacrylic acid) that the "any desired shape" includes porous beads or particles.

Applicants respectfully traverse.

Ko is a deficient reference as discussed above, and claim 1 is believed to be in condition for allowance. Accordingly, the claims dependent thereon are in condition for allowance.

Also, Ko is concerned with preparing absorbent composites, not water-soluble porous materials, and therefore would not have been considered by a person skilled in the art attempting to provide such water-soluble materials. Furthermore, there is no teaching or suggestion in Ko to modify the method it discloses to include any of the aspects discussed above. The teaching in Ko would not therefore have led or motivated the skilled person to provide a method or material according to the amended claims.

Additionally, the production of a substantially water-soluble porous material without the use of chemical initiators or monomers is advantageous in use and the freeze-drying step of the claimed method allows isolation of a solid porous material that retains its structure, rather than providing an expanded foam (see page 4, second paragraph, page 5, second paragraph and page 8, first paragraph of the present application). These advantages would not have been appreciated from the teaching in Ko. Thus, the amended claims of the present application are non-obvious over the disclosure of Ko.

Regarding claim 16, specifically, Butler teaches away from the present invention. The increased temperatures in Butler are undesirable as they give rise to a destabilization of the emulsion and can denature any active ingredient added to the emulsion. Butler *et al.* discloses a general method for producing porous materials by templating super critical carbon dioxide emulsions (see, for example, page 1460, second, fourth and fifth paragraphs, and page 1461, second paragraph of Butler *et al.*). Butler *et al.* fails to provide any of the teaching that is missing from Ko that would have been required in order to have arrived at the method and material of the present invention, i.e. in terms of producing a water-soluble porous material comprising all of the steps of the method of claim 1 of the present application. In particular, it is noted that the method of Butler *et al.* uses cross-linked polymers and does not produce water-soluble materials.

In relation to claim 18 only, Rehmer has been cited as secondary to Ko. Rehmer discloses a process for preparing bead polymers of water-soluble ethylenically unsaturated monomers (see, for example, column 1, second paragraph and column 16, Example 6 of Rehmer) and seems to be of little relevance to the patentability of the present claims.

CONCLUSION

In light of the above remarks, applicants submit that the claims pending in the present application are in condition for allowance. Reconsideration and allowance of the application is respectfully requested. The examiner is invited to contact the undersigned if there are any questions concerning the case.

Respectfully submitted,

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